

***Acanthus ilicifolius* Linn. - Lesser Known Medicinal Plants with Significant Pharmacological Activities**

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Abstract

Acanthus ilicifolius Linn. (Acanthaceae) is relatively lesser-known, yet important medicinal plant of Herbal Materia Medica. The plant is used in traditional systems of medicine, including Traditional Indian Medicine (TIM) or Ayurveda and Traditional Chinese Medicine (TCM). The plant is reported to contain phytochemicals including alkaloid and wide range of glucosides (lignan and phenylethanoid). In traditional medicine, the plant is used in the treatment of diseases ranging from snake bite to skin diseases. Laboratory investigations on extracts of the plant have demonstrated significant pharmacological activities like antioxidant, anticarcinogenic, anti-osteoporotic and hepatoprotective. The review analyses traditional medicinal usage, and phyto-pharmacological investigations done on the medicinal plant.

Keywords: *Acanthus ilicifolius*, traditional medicine, phytochemistry, pharmacology, glucosides

Introduction

Acanthus ilicifolius (sea holly) occurs in tropical Asia and Africa, through Malaya to Polynesia. It is a viny shrub or tall herb, upto 1.5 m high, scarcely woody, bushy, with very dense growth. Shallow tap roots, but occasionally stilt roots are conspicuous. Leaf simple, opposite, decussate, cauline, exstipulate, petiole short, flattened, glabrous, pulvinous to sheathing base. Flower bisexual, typically zygomorphic, complete, erect, sessile, hypogynous. Fruit 1 cm green and 2.5 - 2.0 cm long, kidney shaped 4 seed drupe, Seed 0.5 - 1.0 cm long (Xie *et al* 2005).

Phytochemistry

Two new cyclolignan glycosides, (+)-lyoniresinol 3a-O- β -D-galactopyranosyl-(1 \rightarrow 6)- β -D-glucopyranoside and (+)-lyoniresinol 2a-O- β -D-galactopyranosyl-3a-O- β -D-glucopyranoside have been reported from aerial parts of *A. ilicifolius* (Zhang *et al* 2004). A phenylethanoid glycoside (ilicifolioside A) and an aliphatic alcohol glycoside (ilicifolioside B) have been isolated from the aerial parts (Kanchanapoom *et al* 2002). Two lignan glucosides, (+)-lyoniresinol 3a-[2-(3, 5-dimethoxy-4-hydroxy)-benzoyl]-O-beta-glucopyranoside, and dihydroxymethyl-bis (3, 5-dimethoxy-4-hydroxyphenyl) tetrahydrofuran-9(or 9')-O-beta-glucopyranoside have been isolated from the aerial parts (Kanchanapoom *et al* 2001). 11-epoxymegastigmane glucoside and megastigmane glucosides (roseoside) have been reported from a *A. ilicifolius* growing in China (Wu *et al* 2003). 2-benzoxazolinone and blepharin have been reported from plant growing in Vietnam (Nagao *et al* 2005). A new coumaric acid derivative acancifoliuside, acteoside, isoacteoside, acanthaminoside, (+)-lyoniresinol 3a-O-beta-glucopyranoside, (-)-lyoniresinol, and alpha-amyrin, have been isolated from the methanolic extract of the leaves of *A. ilicifolius* (Huo *et al* 2008).

Traditional Medicinal Uses (Mastaller, 1997)

Malaysia: The leaves of *A. ilicifolius* are used to treat rheumatism, neuralgia and poison arrow wounds. It is widely believed among mangrove dwellers that chewing the leaves will protect against snake bite.

Malay: The pounded seeds of *A. ilicifolius* and *A. ebracteatus* are used to treat boils, and the juice of leaves to prevent alopecia. Both species are also used to treat urolithiasis.

India: In Ayurveda, the plant is known as Sahachara. According to Nadkarni the drug is astringent and makes a good nervine tonic, expectorant, and stimulant. He says that the root is expectorant, and is used in coughs and asthma. The root, boiled in milk, is largely used in leucorrhoea and general debility. Loureiro says that the Siamese and Indo-Chinese consider the roots to be cordial and attenuant, and useful in paralysis and asthma. The tender shoots and leaves are used in India for bite. In Goa, the leaves, which abound in mucilage, are used as an emollient fomentation in rheumatism and

neuralgia.

Thailand: Water extracted from the bark is used to treat colds and dermatitis. Ground fresh bark is used as an antiseptic. Tea brewed from the leaves relieves pain and purifies the blood.

Pharmacology

Anti-inflammatory

The methanolic fraction of *A. ilicifolius* leaf extract produced significant inhibition of rat paw oedema, when administered both prior to and after carrageenan administration, in a manner similar to BW755C a synthetic cyclooxygenase and lipoxygenase inhibitor. The extract decreased protein exudation and leukocyte migration in the peritoneal fluid, thereby indicating its effectiveness towards inhibiting peritoneal inflammation. It also produced significant inhibition of cyclooxygenase (1 and 2) and lipoxygenase activity. Preincubation of the extract inhibited the production of proinflammatory cytokines in lipopolysaccharide stimulated peripheral blood mononuclear cells.

The methanolic fraction of the extract was also found to possess significant free radical scavenging activity. The extract on intraperitoneal administration augmented the endogenous antioxidant status, as evident from the significant increase of ferric reducing ability of plasma and total peroxy radical trapping activity of plasma (Kumar *et al* 2008).

Anti-osteoporotic activity

The effects of the compounds isolated from *A. ilicifolius* on the function of osteoblastic MC3T3-E1 cells were tested. Acteoside, isoacteoside, and (+)-lyoniresinol 3a-O-beta-glucopyranoside (30 microM) increased the growth and differentiation of osteoblasts significantly ($P < 0.05$), indicating that *A. ilicifolius* leaves may help prevent osteoporosis (Van Kiem *et al* 2008).

Hepatoprotective

The alcoholic extract of *A. ilicifolius* leaves inhibited the formation of oxygen derived free radicals *in vitro* with IC (50) of 550 microg/ml, 2750 microg/ml, 670 microg/ml and 600 microg/ml (Fe (2+)/ascorbate system), 980 microg/ml (Fe (3+)/ADP/ascorbate system) for superoxide radical production, hydroxyl radical generation, nitric oxide radical formation and lipid peroxide formation, respectively. The oral administration of the extract (250 and 500 mg/kg) significantly reduced CCl₄ induced hepatotoxicity in rats, as judged from the serum and tissue activity of marker enzymes; glutamate oxaloacetate transaminase, glutamate pyruvate transaminase and alkaline phosphatase. The results were comparable with those obtained with curcumin {100 mg/kg, p.o.} (Babu *et al* 2001).

Chemo preventive

A. To investigate the chemo preventive efficacy of *A. ilicifolius* in a transplantable Ehrlich ascites carcinoma (EAC)-bearing murine model, male Swiss albino mice were divided into four groups: Group

A was the untreated normal control; Group B was the Ehrlich ascites carcinoma control mice group that received serial, intraperitoneal (ip) inoculations of rapidly proliferating 2×10^5 viable Ehrlich ascites carcinoma cells in 0.2 mL of sterile phosphate buffered saline; Group C was the plant extract-treated group that received the aqueous leaf extract of *A. ilicifolius* at a dose of 2.5 mg/kg body weight by single ip injections, once daily for 10, 20 and 30 consecutive days following tumour inoculation (aqueous leaf extract of *A. ilicifolius*); and Group D was the Ehrlich ascites carcinoma + aqueous leaf extract of *A. ilicifolius* treatment group (Chakraborty *et al* 2007).

The chemopreventive potential of the aqueous leaf extract of *A. ilicifolius* was evaluated in a murine model by studying various biological parameters and genotoxic markers, such as tumour cell count, mean survival of the animals, haematological indices, hepatocellular histology, immuno-histochemical expression of liver metallothionein protein, sister-chromatid exchanges, and DNA alterations. Treatment of the Ehrlich ascites carcinoma -bearing mice with the aqueous leaf extract of *A. ilicifolius* significantly ($P < 0.001$) reduced viable tumour cell count by 68.34% ($228.7 \times 10^6 \pm 0.53$) when compared to Ehrlich ascites carcinoma control mice ($72.4 \times 10^6 \pm 0.49$), and restored body and organ weights almost to the normal values. Aqueous leaf extract of *A. ilicifolius* administration also increased ($P < 0.001$) mean survival of the hosts from 35 ± 3.46 d in Ehrlich ascites carcinoma control mice to 83 ± 2.69 d in Ehrlich ascites carcinoma + aqueous leaf extract of *A. ilicifolius* treated mice.

B. Alcoholic extract of *A. ilicifolius* (250, 500 mg/kg b wt) was found to be effective against tumour progression and carcinogen induced skin papilloma formation in mice. The extract was found to be cytotoxic towards lung fibroblast (L-929) cells in 72 h MTT assay and the concentration required for 50% cell death was 18 $\mu\text{g/ml}$. Oral administration of the extract (500 mg/kg b wt) reduced the tumour volume and administration of the same concentration increased the life span by 75% in ascites tumour harbouring animals. The extract also significantly delayed the onset of dimethylbenzanthracene/Croton oil induced skin papilloma in mice in a dose dependent manner (Babu, Shylesh and Padikkala, 2002)

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